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# P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Sixth Semester, B.E. - Mechanical Engineering

Semester End Examination; June - 2017

Statistical Quality Control

Time: 3 hrs

Max. Marks: 100

**Note:** i) Answer any **FIVE** full questions, selecting atleast **ONE** full question from each **unit**.  
ii) *SQC tables permitted.*

## UNIT - I

- 1 a. Define quality and quality control. 4
- b. Explain the objectives of quality control. 8
- c. What is quality of design? Explain the factors controlling quality of design. 8
- 2 a. Explain the classification of quality costs. 12
- b. Write a note on optimum quality. 8

## UNIT - II

- 3 a. Explain the concept of variations with suitable examples. 6
- b. Define the following: 6
  - i) Mean
  - ii) Standard Deviation
  - iii) Median.
- c. The following grouped frequency distribution describes the measurements of 200 containers in cm<sup>3</sup>:
  - i) Draw the histogram for this data and determine the modal volume
  - ii) Draw a cumulative frequency curve and estimate the median value of volume.

Volume of containers	No. of containers
6 and less than 7	2
7 and less than 8	6
8 and less than 9	49
9 and less than 10	121
10 and less than 11	19
11 and less than 12	3

- 4 a. Draw three normal distribution curve: 8
  - i) Different means but identical standard deviations 6
  - ii) With different standard deviations but identical mean.
- b. The mean inside diameters of a sample of 400 washers produced by a machine is 8.92 mm and standard deviation is 0.12 mm washers with inside diameter within the range of 8.74 to 9.1 mm are acceptable. Calculate the defective washers produced by the machine. Assume the diameter is normally distributed. 6

- c. 10 gauges 7 new and 3 old are kept in identical boxes on a shelf in stores. The storeman takes two at a random from the shelf. Determine the probability that they contain:
- i) 2 old gauges
  - ii) One old and one new gauge.

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**UNIT - III**

- 5 a. Compare process capability with specification limits and offer your comments on different situations.

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- b. Control charts for  $\bar{x}$  and R are maintained for the diameter of the shafts. After 25 subgroups of five items each have been recorded as

$$\sum \bar{x} = 159.5725 \text{ mm and } \sum R = 1.1625 \text{ mm.}$$

- i) Determine the control limits and represent graphically
- ii) Calculate the process capability.

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- 6 A machine is working to a product specification of  $12.58 \pm 0.05$  mm. Ten subgroups of size 5 were inspected and the following data was obtained.

Subgroup No.	X	R
1	12.64	0.05
2	12.60	0.07
3	12.59	0.07
4	12.62	0.06
5	12.50	0.03
6	12.60	0.06
7	12.58	0.05
8	12.59	0.04
9	12.62	0.05
10	12.60	0.06

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- i) Determine process capability
- ii) Setup  $\bar{x}$  and R charts offer your comments
- iii) Calculate percent defective if any
- iv) If machine setting can be changed could you recommend a change? If so, what is the improvement?

**UNIT - IV**

- 7 a. Distinguish between defects and defective quoting examples.

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- b. The following are the inspection results of 20 lots of magnets each lot containing 750 magnets. The number of defective magnets in each lot are 48, 56, 47, 71, 83, 48, 50, 53, 70, 67, 47, 34, 85, 37, 57, 29, 45, 52, 51, 30 construct a suitable control chart. What process average would you recommend for the future?

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- 8 a. Explain classification of defects. 6
- b. A company starts a new unit for manufacturing a oil cloth in order to have quality control programme the following data from inspection were collected:

Lot no.	Sq. m of oil cloth inspected	No. of non conformities.
1	200	5
2	250	7
3	100	3
4	90	2
5	120	4
6	80	1

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Draw an appropriate control chart. What are your recommendations?

**UNIT - V**

- 9 a. Explain the advantages of sampling inspection over 100% inspections. 8
- b. A single sampling plan is as follows  $n = 20$   $C = 1$ . Write the equation of probability of acceptance in terms of fraction defective using binomial distribution use the equation obtained and plot an OC curve. 12
- 10 a. Write a note on sequential sampling plan. 6
- b. A sampling plan is as follows. Select a sample of 2 from a lot of 20. If both articles inspected are good accept the lot, if the both are defective reject the lot, if one good and one defective take a second sample of 2, if both are good accept the lot. If both are bad reject the lot, if one good and one defective take a third sample of 1 (one) of the article in the third sample is good accepting the lot otherwise rejecting the lot. 14
- i) Write the sampling plan using the standard notations
- ii) Write the equation of OC curve
- iii) If 25% defective lot is submitted what is the actual probability of acceptance.

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